SUMMARY OF INFORMATION ON THE

SITE OF THE FIRST SELF-SUSTAINING CONTROLLED NUCLEAR CHAIN REACTION

EAST SIDE OF ELLIS AVENUE,
BETWEEN 56TH AND 57TH STREETS
CHICAGO, ILLINOIS

AUGUST, 1971

SITE OF THE FIRST SELF-SUSTAINING CONTROLLED NUCLEAR CHAIN REACTION

East side of Ellis Avenue, between 56th and 57th Streets
Chicago, Illinois

Date of Event that is Commemorated: December 2, 1942, 3:25 P.M.

IPhysical Description of Site:
On the east side of Ellis Avenue, between 56th and 57th Street, four plaques mounted on a low, upright granite slab and a monumental abstract sculpture, "Nuclear Energy," by Henry Moore mark the historic site at the University of Chicago where man first initiated a self-sustaining chain nuclear reaction and controlled it.

Behind the plaques and sculpture, the Regenstein Library, which was completed in 1970, provides a backdrop of modern architecture.

There is no trace of the old Stagg Field or of its west grandstand, under which was concealed the squash racquets court which became the laboratory where the experiment that ushered in a new era in science and a new age in human affairs took place.

The first of the plaques was originally unveiled on the outside wall of the west grandstand in 1947. When the stand was demolished in 1957, the plaque was saved for reinstallation in a suitable spot. It reads:

ON DECEMBER 2, 1942
MAN ACHIEVED HERE THE
FIRST SELF-SUSTAINING CHAIN REACTION
AND THEREBY INITIATED THE
CONTROLLED RELEASE OF NUCLEAR ENERGY

The site was designated a Registered National Historic Landmark at a ceremony in Secretary of the Interior Stewart L. Udall's office on December 2, 1964. Enrico Fermi, who had headed the experiment, died in 1954, but two nuclear scientists who had taken part in the project, Samuel K. Allison and Herbert L. Anderson, attended along with other representatives of the University of Chicago. Secretary Udall presented the University representatives with the second plaque that now also marks the site. This one reads:

SITE OF THE FIRST SELF-SUSTAINING
NUCLEAR REACTION

HAS BEEN DESIGNATED A
REGISTERED NATIONAL
HISTORIC LANDMARK

UNDER THE PROVISIONS OF THE
HISTORIC SITES ACT OF AUGUST 21, 1935.
THIS SITE POSSESSES EXCEPTIONAL VALUE
IN COMMEMORATING AND ILLUSTRATING
THE HISTORY OF THE UNITED STATES

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
1965

In a message to Secretary Udall, George W. Beadle, then president of the University of Chicago, said:

> The Chicago site is singular in the world's history. As we accept this token of observance, rather than celebration, I want to note that so historic a day and so great a demonstration of man's capability still have no material monument. The squash rackets court that served as the emergency laboratory and the concrete stands which covered it are gone. . . . However, our University community joins with the rest of the academic world in hoping that an impressive and fitting memorial soon will be created.

Plans for the "fitting memorial" had been under way for a year, for it was in 1963 that President Beadle established a committee to plan the 25th anniversary of the historic break-through. After several meetings, three members of the committee flew to London to discuss the development of a monument with the famous sculptor Henry Moore. Later, Moore came to Chicago to visit the site and confirm arrangements for the work.

The 6,000 pound, 12-foot-high, bronze sculpture was developed over a four-year period in Moore's studio outside London and cast, under his supervision, by Noack's Foundry, West Berlin. The sculpture arrived in Chicago by ship on October 27, 1967, and was mounted on a disc-shaped base of black polished granite, 9'6" in diameter, at its present site.

Since 1940, Moore had been concerned, off and on, with what he called his "helmet-head" theme, and it was this theme that he employed in the work to which he gave the title "Nuclear Energy." In fact, shortly before the University committee asked him to do a sculpture commemorating the 25th anniversary of the first controlled atomic chain reaction, Moore had completed a 5-inch model for another in his series of helmet heads. It was from this that he developed "Nuclear Energy."

In an interview with Franz Schulze, Chicago Daily News art critic, at the time of the dedication of "Nuclear Energy," Moore said:

> The helmets in the medieval armor section of the Wallace Collection in London have always fascinated me. They have a purity of metal and a strength, outwardly; yet within, they convey an enclosedness, a quality of protection. These are the things I want to capture in my own variations on the theme.
>
> Nuclear energy is not unlike this in its implications. It is a splendid force for good, and just as surely a force for evil. As I worked on this piece, I gradually saw the top part of it taking on the aspect of a skull--a death's head.

In another statement about the sculpture, Moore said:

> I prefer to let my work speak for itself, but sometimes it is possible to give a hint or a clue of what was in one's mind in making the sculpture. In this, the upper part is very much connected with the mushroom cloud of an atomic explosion, but also, it has the shape and eye sockets of a skull. The lower half of the sculpture is architectural, and in the arched cavities and domed interiors, I had reminiscenses, in my mind, of the inside of a church or cathedral. The whole sculpture was meant to have a contained power and force.

The two remaining plaques have to do with the sculpture. One reads:

NUCLEAR ENERGY
HENRY MOORE-SCULPTOR
DEDICATED DECEMBER 2, 1967
THE 25TH ANNIVERSARY OF THE
FIRST CONTROLLED GENERATION OF NUCLEAR POWER
AN EXPERIMENT BY ENRICO FERMI AND HIS COLLEAGUES

The sculpture was purchased from Moore for the citizens of Chicago by the trustees of the Art Institute of Chicago in their capacity as trustees of the B. F. Ferguson Fund. It is this fact that is noted in the small plaque reading:

THIS SCULPTURE WAS PROVIDED
BY THE TRUSTEES OF THE

B. F. FERGUSON
MONUMENT FUND
1967

Other monumental works by Moore include his stone sculpture for the UNESCO Building in Paris, his 28' bronze "Reclining Figure" for Lincoln Center, New York City, and his bronze "Family Group" in the Museum of Modern Art, New York.

In connection with the unveiling of "Nuclear Energy," the University of Chicago Renaissance Society and the University's Committee for the 25th Anniversary Observance of the First Nuclear Chain Reaction, sponsored an exhibit on campus of 70 sculptures and several drawings by Moore, all from private collections in the Chicago area.

Historic Background:

The events that led up to the atomic chain reaction of December 2, 1942, can be said to have begun in Paris in 1896, when Antoine Henri Becquerel discovered the existence of radioactive elements. Other experiments may be noted. In 1898, also in Paris, Pierre and Marie Curie discovered the element radium. In 1905, in Zurich, Albert Einstein announced his famous "Theory of Relativity," which states that mass equals energy. In 1912, Ernest Rutherford discovered the nucleus, or core, of the atom. Shortly after World War I, he achieved the artificial disintegration of the nucleus of the nitrogen atom. Research progressed steadily. In 1932, discoveries by Walter Bothe in Germany and Frederic Joliot-Curie in Paris led to the discovery of the neutron (an electrically neutral particle which exists in the nucleus of some atoms) by James Chadwick of England. In 1934, in Rome, Enrico Fermi showed that these neutrons could disintegrate many atoms, including those of uranium. The final stepping stone was put in place in 1939, in Berlin, when Otto Hahn, with Fritz Strassman, discovered fission, or the splitting of the uranium atom. This opened the possibility of a form of nuclear (atomic) energy.

Meanwhile, Fermi had received the Nobel Prize in Physics in 1938 and, with his family, had immediately emigrated from fascist Italy to the United States. Upon arriving in January, 1939, he went directly to Columbia University, where an appointment awaited him. As soon as he was settled, he started to gather a group of physicists about him. Three early members of the group--Herbert Anderson, Leo Szilard, and Walter H. Zinn--were to remain with Fermi through the victory over nuclear energy at the University of Chicago.

In August 1939, three Hungarian physicists who like Fermi had immigrated to the United States--Szilard, Eugen Wigner, and Edward Teller--called on Albert Einstein to apprise him of the research on uranium being conducted at Columbia and ask his support in bringing the tremendous potentialities to President Roosevelt's attention. They had drafted a letter for Einstein's signature (which was certain to get attention), informing the President that "recent work by E. Fermi and L. Szilard. . .leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future." The letter said that a nuclear chain reaction could almost certainly "be achieved in the immediate future" and that "this new phenomenon would also lead to the construction of bombs."

Einstein signed the letter and, as a result, the President acted on its suggestion that the Administration maintain contact with the physicists and help to secure a supply of uranium ore and funds to speed up the experimental work. The Advisory Committee on Uranium was established.

On December 6, 1941, the day before the Japanese attack on Pearl Harbor and the entrance of the United States into World War II, it had been decided to intensify all research on nuclear fission and to transfer Fermi and his associates working on chain reaction at Columbia to the University of Chicago. This research in Chicago was under the direction and co-ordination of Professor Arthur H. Compton. It was he who was officially in charge of the Metallurgy Laboratory--or "Met. Lab."--where no metallurgists worked and which was given its name to conceal its identity.

It was now clear that if a sufficient quanity of uranium could be brought together in a "pile" under proper conditions, a self-sustaining chain reaction would result, attaining a "pile" of critical size. A "pile" (the name applied to all such devices) of uranium and graphite had already been constructed at Columbia. At Chicago, therefore, a series of atomic piles were constructed in a secret laboratory across the street from the Met. Lab. Subjected to the strictest security, the hidden laboratory occupied the racquets court under the west stand of Stagg Field.

The piles constructed during the first months were sub-critical--that is, incapable of producing a self-sustaining nuclear chain reaction. Later, data obtained from these experimental piles indicated that it was now time to construct a test pile of critical size.

Day after day, the pile grew toward final shape. In the early afternoon of December 1, 1942, tests indicated that critical size was rapidly approaching. Soon there would be sufficient uranium on the pile so that the few neutrons emitted in a single fission would strike neighboring atoms, which in turn would undergo fission and produce more neutrons--thus creating a self-sustaining reaction. Shortly after 4:00 p.m., the last layer of graphite and uranium bricks was placed on the pile. Fermi was not there, however, so rods of cadmium which would control the experiment by absorbing the neutrons (thereby stopping the bombardment process), were locked in until the next day. At 9:45 a.m. on December 2, Fermi, surrounded by 49 colleagues, ordered the first of the control rods withdrawn. The climax of the great experiment had begun.

Description of Site at Time of Event and of the Event Itself:
There is no more vivid description of the makeshift laboratory in which Enrico Fermi and his colleagues succeeded in unlocking the secret of the atom than that spoken by University of Chicago Professor of History William H. McNeill, a member of the committee which planned the 25th anniversary observance, on the occasion of that ceremony. Speaking from the platform on which sat dignitaries of the University, sculptor Henry Moore, scientists who had taken part in the experiment, and the widowed Mrs. Fermi, McNeill said, in part:

> The pile stood in an abandoned squash racquets court--not a squash court, as is sometimes mistakenly said, but a squash racquets court--much larger and loftier. The room, lined with dark grey slate, was bathed in bright, harsh light intended to allow grown men to follow the swift darting of a small rubber ball. A small balcony in the rear, where spectators had once been allowed, provided Fermi with a command post from which to direct the famous experiment.
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> The whole thing lay hidden in the bowels of the West Stands--an extraordinary edifice that had been constructed in the early 1920's in an ill-advised outburst of Gothic enthusiasm and concrete economy. It was, of course, intended to accommodate crowds that came to watch the football heroes of those days, who won and lost for Mr. Stagg and Old Maroon on many an autumn afternoon--little thinking what strange and different uses Stagg Field would one day be put to.
>
> What an amazingly incongrous setting for the inaugeration of the atomic age.
>
> The racquests court was chosen because it was the only easily available space with a high enough ceiling to accommodate a pile of 20 feet cubed. Yet I venture to suggest that the Fermi Institute across the street, and the entire complex of other new physics and chemistry buildings near by, owe their present location to the odd accident that the racquets court became the center of secret work of the greatest importance--and all because of a high-ceilinged room was mighty hard to come by in 1942. . .
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> Outside it was cold, with snow on the ground, on December 2, 1942. It was cold inside too; heating arrangements were sketchy and the wind whistled all round through the dimly lit underside of the concrete stands. . . .

Noting that he, who had been "far away and entirely ignorant of what was going on," could only try to imagine what it must have been like, the Pulitzer-prize-winning historian proceeded to describe the scene and the momentous event in the vivid, perceptive language that marks his highly acclaimed books:

> The dark, brooding presence of the pile itself was shrouded by an envelope of air-tight fabric. Wooden supports and temporary guard rails, constructed of rough 2 by 4's, were much in evidence. So, of course, were the control rods of cadmium, whose withdrawal from the interior of the pile would, according to Fermi's calculations, allow spontaneous chain reactions among the uranium atoms to set in and become self-sustaining.
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> But until it had actually been done, and measurements made, no one could be absolutely sure. Some error of figuring, some factor unforeseen or unimagined, might always interfere. So the test was a drama. It ought to work--but would it really? Those who knew what was afoot were tense with an excited expectation. . .

Reading about how the experiment was made ready, I come away with the overwhelming retrospective impression of how simple and makeshift everything was. From the old spectators' balcony some ten feet above the floor, Fermi controlled the scene. On the floor below, eager young hands adjusted the clumsy control rods as directed, using ordinary human muscles to push them in and out. A bucket brigade stood by, poised to pour a chemical pacifier over the pile, if, by some mischance, it should flare up out of control. And the emergency control rod, held in place by a rope, was attended by a hatchet man, ready at the first sign of trouble, to sever the restraining rope with a single stroke. The scene seems now so simple, makeshift, ordinary; yet at the same time so eerie, strange, and absurd. Secrecy, haste, hope, and fear, as well as skill, ambition, theory, and practice, all came together on that day in ways men will always remember, and we should ponder.

The experiment began in the morning. The lengthy control rods came out, bit by bit, at Professor Fermi's orders. Each time the measured intensity of neutron emission increased as had been hoped and expected. About mid-day, the rods were pushed in and the group dispersed for lunch. Again, the human scale of the affair obtrudes--lunch in the midst of earth-shaking adventure.

The experiment's routine resumed in the afternoon. The pile warmed up again, and at 3:25 p.m. Fermi gave the order to withdraw the control rod the final foot which would, according to his calculations, put the reaction finally over the top and make it self-sustaining.

For 28 minutes the reaction continued. Man had initiated a self-sustaining nuclear chain reaction and then stopped it. He had released the energy of the atom's nucleus and controlled that energy.

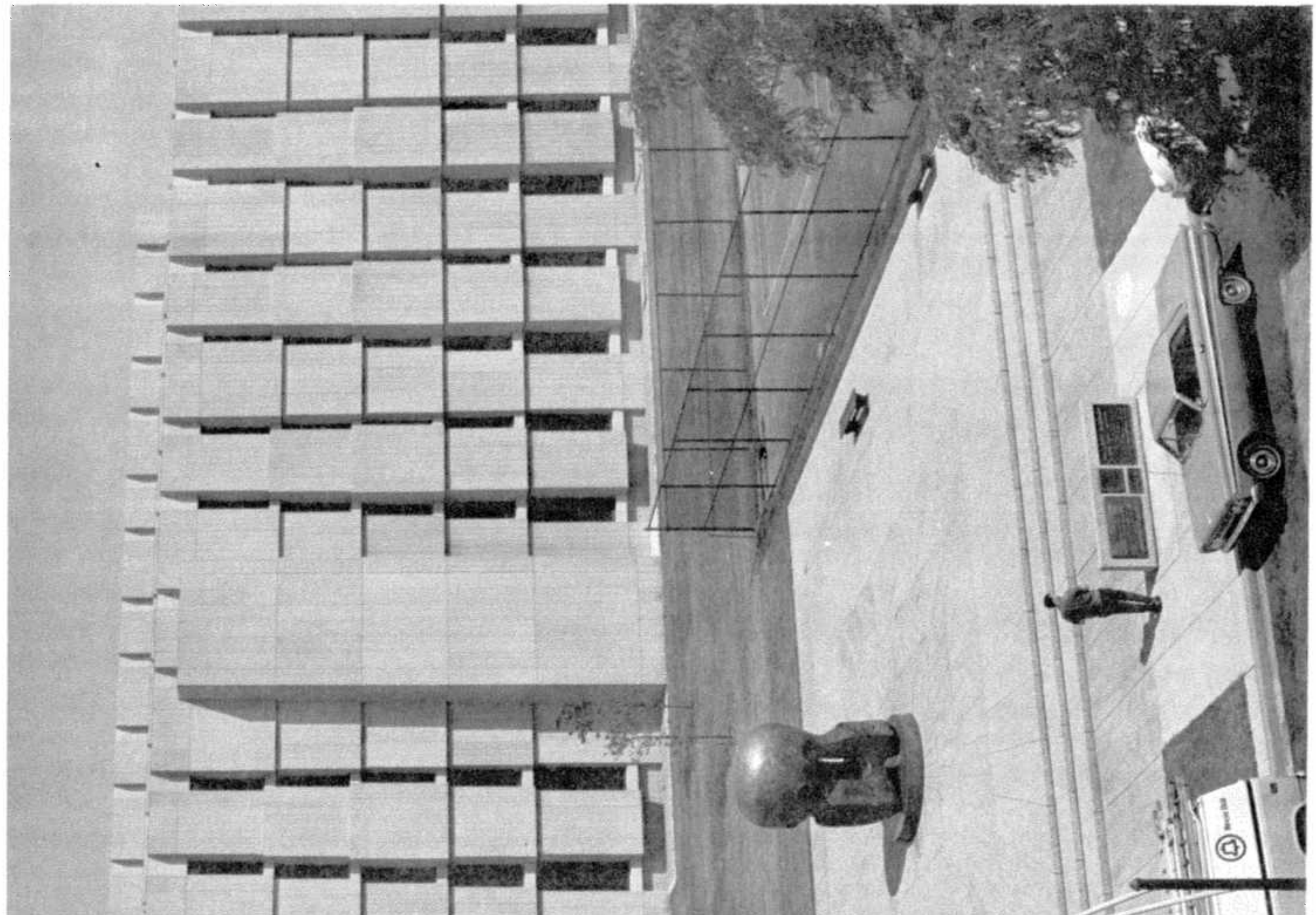
Significance of Site and Event Related to It:

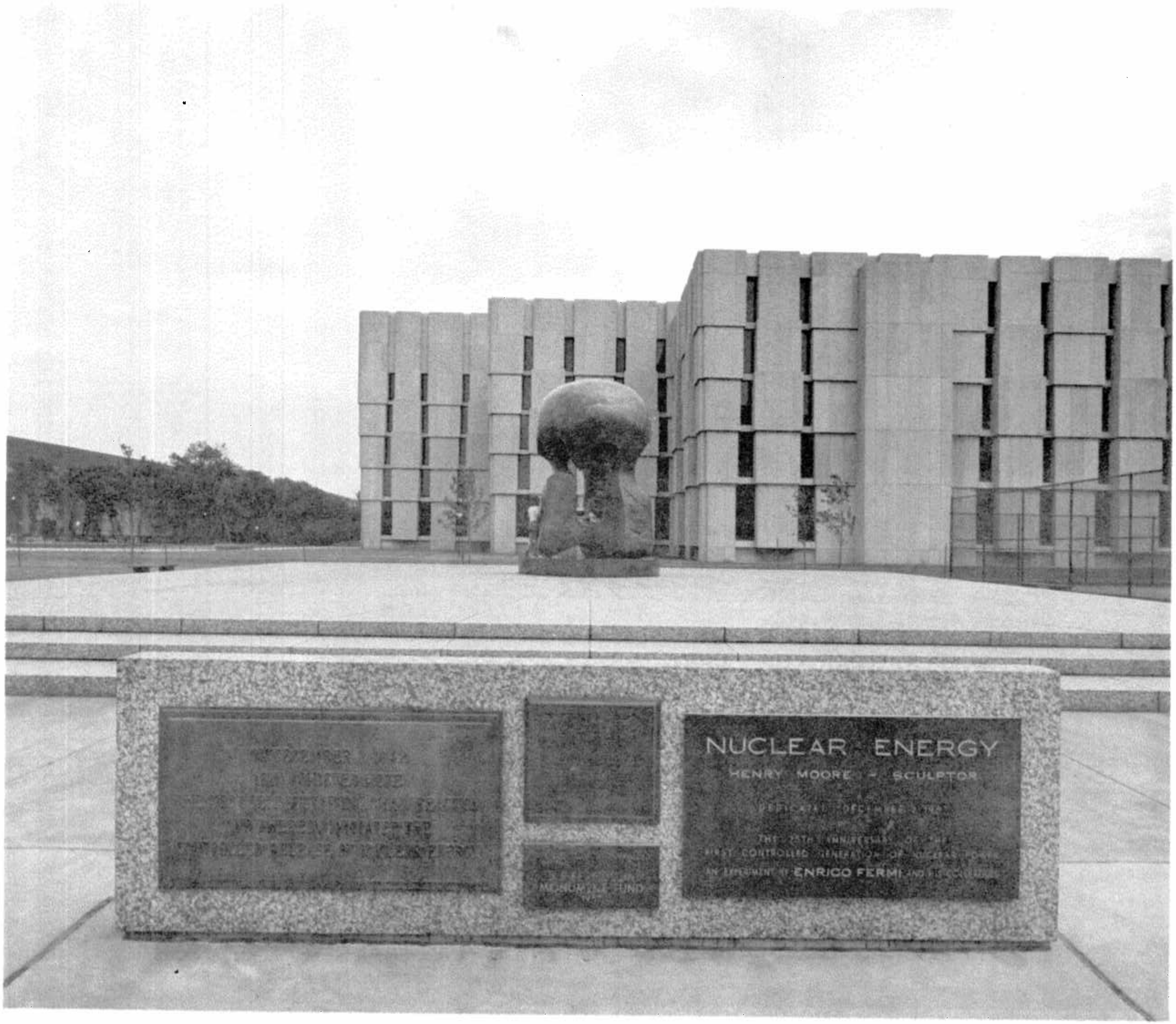
The implications of this experiment were clear. Fermi noted two years before his death, in the November 23, 1952 issue of the Chicago Sun-Times, that "the future development of atomic energy during the next three years focused on the main objective of producing an effective weapon." The first atomic chain reaction experiment was designed to proceed at a slow rate, unlike the atomic bomb, which was designed to proceed at as fast a rate as possible. Otherwise, the basic process, according to Fermi, was similar to that of the atomic bomb.

In the same article, Fermi stated that the hope of his team had been that, with the end of the war, emphasis would be shifted decidely from weapons to the peaceful aspects of atomic energy. They hoped that perhaps the building of power plants, and the production of radio-active elements for science and medicine would become paramount objectives. Dr. Glenn T. Seaborg in 1967, Chairman of the U. S. Atomic Energy Commission then, and once a member of Fermi's team, expressed the opinion that possibly the most significant benefit of man's harnessing of nuclear energy in the atom is the generation of electricity. Peace, not war was the ultimate aim of the scientists.

Concern was expressed that the importance of man's achievement in 1942 not be forgotten. At the close of the 25th anniversary ceremony, when the Henry Moore sculpture was dedicated, McNeill noted:

> Long may it stand, to say to all who come this way that on this spot men once knew, felt, feared, and aspired in ways far surpassing the usual range of experience. May this place, in fact and deed, be holy ground, to us and our successors, generation after generation, as long as men survive and know enough to reverence landmarks from the human past.

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